This is the pre-peer reviewed version of the following article: Sagner, J. S. (2007), Capital budgeting: Problems and new approaches. J. Corp. Acct. Fin., 19: 39–44. doi: 10.1002/jcaf.20355, which has been published in final form at http://onlinelibrary.wiley.com/doi/10.1002/jcaf.20355/abstract.

Problems with Capital Budgeting and the "Discounted Payback Plus" Solution

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2007

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1. Capital Budgeting Procedures

The evaluation of capital budgeting projects follows long established protocols usually involving any of the following procedures: net present value (NPV), internal rate of return (IRR), or payback.[1] In brief, NPV calculates the present value of all cash flows at the company's cost of capital; IRR determines that interest rate that forces the equality of out- and inflows; and payback determines the time required to recover a project's cash outflows using its future inflows.

There have several studies in the past 15 or so years on the use of each capital budgeting technique (see, e.g., Burns and Walker, 1997), with the leading analysis by Graham and Campbell (2001, 2002), hereinafter "GC". This latter study received 392 responses from chief financial officers to survey questions sent to nearly 4,500 firms. Most respondents stated that their capital budgeting uses discounted cash flow (DCF), with preference about equal among IRR and NPV. Payback effectively tied for third place with "hurdle rate" (GC, web version, Table 2, 2001).

The authors' observation on this point is interesting: the use of payback "… is surprising because financial textbooks have lamented the shortcomings of the payback criterion for decades." (GC, web version, page 6, 2001). They reject the quite reasonable explanation that firms with capital constraints need to recover investments quickly or conceivably face ceasing operations. Instead, their observation is that payback is used by less sophisticated, older managers without MBAs, and presumably, as they die or retire, this deficiency will be resolved (GC, web version, pages 6-7, 2001)!

2. Explanations for Current Practice

The passage of time aside, the survey evidence compiled by GC does not explain the interesting inconsistency between what is stated by these CFOs – effectively "we use NPV and IRR" – and the reluctance of companies to rely on DCF results for investment decisions. Although no formal survey has been performed regarding this conclusion, there are at least three factors that support this hypothesis regarding DCF:

1. Do CFOs trust the results from DCF analysis? With some 57% of firms using payback (vs. about 75% for NPV and IRR) (GC, web version, Table 2, 2001), GC determined that the surveyed companies use payback as well as other capital budgeting techniques in support of NPV and IRR. This point is never clearly explained in their article. However, the total of all responses to the question "How frequently does your firm use the following techniques when deciding which

[1] See any standard finance textbook for an explanation.

projects or acquisitions to pursue?" is 467.3%.[2] Because this far exceeds 100%, it is evident that financial managers are uncomfortable relying on one answer in making capital budgeting decisions. As the result, they compare calculations from two or more procedures, leading to multiple responses to this survey question.

2. Are attractive projects available? Financial analysts are beginning to recognize that worthwhile capital investments are unusual and are likely to be short-lived. In other words, the reality of global competition shortens any competitive advantage a company may gain, unless protected by patents or other exclusive arrangements. To quote a leading finance text:

   > It is a basic principle of economics that positive NPV investments will be rare in a highly competitive environment. Therefore, proposals that appear to show significant value in the face of stiff competition are particularly troublesome, and the likely reaction of the competition to any innovations must be closely examined (Ross et. al., 2007, page 275).

3. Are investments actually being made? Despite the availability of funds, companies are simply not investing in capital projects. Two recent studies clearly explain the predicament that businesses face: too much money on balance sheets and too few attractive capital investments. The Association of Financial Management (AFP) conducted a recent study supported by Credit Suisse which reported that 40% of respondents held larger amounts of short-term investments than six months earlier (Roth et. al., 2006).[3] Furthermore, the expectation is that these balances will grow over the coming year. A second study reports that cash balances have expanded 50% in seven years, with the total of cash and short-term investments at $5.4 trillion, up 7.5% just in the past year (Labate, 2006, page 29).

3. Deficiencies in DCF Capital Budgeting

It is now being recognized that funds cannot be assigned to projects with sufficiently high enough NPVs, IRRs or returns calculated by traditional methods to risk medium- to long-term investments. The huge cash hoard amassed by U.S. businesses reflects the gap between financial theory and practice: through hard experience, managers have learned that an IRR or an NPV analysis cannot be trusted. While mathematically sound and certainly widely accepted in the literature, these techniques have encouraged companies to invest in projects with long lives that often fail to:

[2] Derived from data in Table 2 (GC, web version, 2001). In addition to NPV, IRR and payback, financial managers reported using the following techniques: hurdle rate, sensitivity analysis, earnings multiple approach, discounted payback period, real options, accounting rate of return, value-at-risk or other simulation, adjusted present value and profitability index.

[3] The typical holdings were in money market funds, bank deposits and commercial paper.

- Provide the benefits (cash inflows) forecast, particularly in distant years. Predictions of future cash inflows tend to be optimistic, and are often based more on hope and the desire that a capital project be funded rather than on hard research and specific evidence.

- Be completed for the cost (cash outflows) expected, given unexpected cost overruns, price surges for raw materials, delivery delays, and faulty design.

A further failure is that IRR, although widely used by financial managers, inherently assumes that all future cash flows from a project will be reinvested at the IRR rather than at the cost of capital. This results in the acceptance of more projects that have an IRR greater than the cost of capital than can possibly generate equivalent IRRs.

4. IRR vs. MIRR

As a modification of IRR, a related procedure generally known as modified internal rate of return (MIRR) has been developed. MIRR determines the interest rate that equates the future value of cash inflows, each of which grows at the cost of capital, with cash outflows.

The following example shows the difference between IRR and MIRR for a series of cash flows where the initial outflow or cost is $200,000, and the cost of capital is 10%.

Year 1	$120,000
Year 2	100,000
Year 3	57,000

The calculated value of the IRR is 20.87%, while the value of the MIRR is 16.00%, as determined from data in Table 1.

Table 1: Calculation of the Modified Internal Rate of Return

	Present Value	Periods	Future Value
Year 1	$120,000	2	$145,200
Year 2	$100,000	1	110,000
Year 3	$57,000	0	57,000
Terminal Value			$312,200

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Using a financial calculator, the MIRR (the interest rate) for $200,000 of present value and $312,200 of future value for three years is calculated. This result is more realistic and conservative than the IRR but continues to use dubious cash flow projections for future years. As the result of hard experience, many financial analysts no longer believe the flow projections provided by those requesting budget allocations, and realize that any numbers are merely “guestimates” of future behaviors.

For this reason, payback has come back into popularity even though financial texts often disparage the procedure as naïve in that there is no accounting for the time value of money or for cash inflows received after the payback period. Using the above example, payback would occur during the second year. To be precise, the cash outflows of $200,000 are recovered after $80,000 is earned in year 2 (in which a total of $100,000 is the expected cash inflow). This would be at 1 80/100 years, or 1.8 years. Although most projects with such short paybacks would be approved, there is no standard or generally agreed upon period for an approve/disapprove decision.

5. Discounted Payback Plus

An interesting alternative approach may be to determine the return on a project at the projected payback moment plus an assigned probability of cash inflows beyond the payback period. For the purpose of identifying the proposed technique, it is labeled in this paper as Discounted Payback Plus (DPP).[4] No technique currently in general use assigns probabilities to these possible future cash flows to calculate the expected value. However, sensitivity analysis, used by 51.5% of respondents in the survey by GC, is similar to DPP in that it requires the analysis of changes in the projected value of a component of cash flow. Scenarios are often developed for base, best and worst case outcomes with varying results under various assumptions.

DPP would permit the evaluation of a capital project based on management's experience with the requesting business unit. Some managers are realistic in their projections, while others may inflate cash forecasts in hopes of receiving funding or because of other motives that have little to do with rational capital budgeting analysis. A business line manager may conclude that the company rewards its executives based on the size of the business unit's budget and/or the number of employees, and may adjust cash inflow forecasts accordingly.

A second factor that suggests the use of probabilities is the direct measurement of the risk of a project. Corporate finance texts have long argued for the use of a risk-adjusted cost of capital; that is, an arbitrarily assigned premium or discount to the cost of capital based on the risk category of a project. For example, new products or lines of business may be considered as high risk, and could be evaluated with a cost of capital 4% higher than the company's cost of capital. Replacement of equipment for existing products or lines of business may be considered as low risk, and evaluated with a cost of capital 1% higher than the cost of capital. However, this technique approaches risk from the perspective of the cost of funds rather than from the returns earned by the investment.

[4] This is not to be confused with "discounted payback", a techniques that discounts cash inflows to the cash flow break-even point to determine the time to payback.

6. Calculating the DPP

To calculate the DPP, the data in Table 1 for MIRR are restated to include the full amount of the cash flows to payback. If we next assume a 50% probability for the additional cash inflows (beyond the payback period), the return would be calculated as 10.55%;[5] see Table 2 for specific data. With a cost of capital of 10%, the slight positive return is probably insufficient to proceed with the investment. Effectively this is known intuitively within finance, which hopes to see attractive, quick returns from a project.

Table 2: DPP at 50% Probability for Flows beyond Payback

	Present Value	Periods	Future Value
Year 1	$120,000	2.0	$145,200
Year 1.8	$80,000	0.8	$86,338
Year 0.2 (in year 2)*	$10,000	0.2	$10,192
Year 3*	$28,500	0.0	$28,500
Terminal Value			$270,230

*Assumes cash inflows beyond payback at 50% of forecast amounts

Any reasonable assumption can be made about flows beyond the payback period, with the calculations adjusted accordingly. Management may assign a 75% probability to those flows based on previous experience with the requestor or other factors. In this situation, the data in Table 2 would be restated as shown in Table 3, and the return would be 13.13%. As this result is considerably higher than the cost of capital, the project would likely be accepted.

Table 3: DPP at 75% Probability for Flows beyond Payback

	Present Value	Periods	Future Value
Year 1	$120,000	2.0	$145,200
Year 1.8	$80,000	0.8	$86,338
Year 0.2 (in year 2)⬩	$15,000	0.2	$15,289
Year 3⬩	$42,750	0.0	$42,750
Terminal Value			$289,577

⬩Assumes cash inflows beyond payback at 75% of forecast amounts

The financial analyst can adjust expected values for each period beyond the payback point, based on any matters that are business unit specific or represent risk perceptions for the type of investment.

[5] Keystrokes on a Texas Instruments BAII PLUS would be as follows: [2ND] [RESET] [ENTER] [3] [N] [200000] [+/-] [PV] [270230] [FV] [CPT] [I/Y].

7. Conclusions

Probably only a limited number of projects will pass the fairly rigorous DPP criterion explained in this paper. However, as we have seen, few projects are being funded at present, and management needs to move from resistance and fear to some form of thoughtful analysis. Furthermore, the simplicity of IRR is just that – the punching of a few keys on a financial calculator rather than thoughtful consideration of what the cash flows are forecast to be, who is making the forecast, and the clear imperative of being assured of recovering cash flows invested in a capital project.

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